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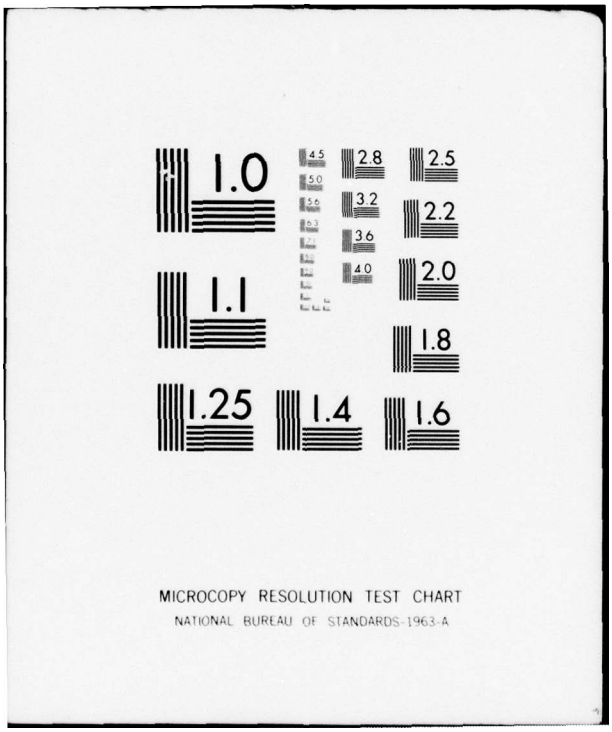
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A METHODOLOGY FOR PREPARING ENVIRONMENTAL ASSESSMENTS

ARTHUR D. LITTLE, INC.
CAMBRIDGE, MASSACHUSETTS

NOVEMBER 1976

Final Report For Period Mar 1975 to Nov 1976

Approved for public release; distribution unlimited

AIR FORCE CIVIL ENGINEERING CENTER
(AIR FORCE SYSTEMS COMMAND)
TYNDALL AIR FORCE BASE
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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: AFCEC-TR-76-9	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE *(and Subtitle)*: A METHODOLOGY FOR PREPARING ENVIRONMENTAL ASSESSMENTS.	5. TYPE OF REPORT & PERIOD COVERED: Final Report, Mar 75 - Nov 76
6. PERFORMING ORG. REPORT NUMBER	
7. AUTHOR(s): David I. Hellstrom	8. CONTRACT OR GRANT NUMBER(s): F29601-74-D-0027 Call Order No. 007
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Arthur D. Little, Inc Acorn Park Cambridge Massachusetts 02140	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: JON: 21038E25
11. CONTROLLING OFFICE NAME AND ADDRESS: Air Force Civil Engineering Center (AFSC) Air Force Systems Command Tyndall Air Force Base, Florida 32403	12. REPORT DATE: November 1976 13. NUMBER OF PAGES: 42 (41 p.)
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*	15. SECURITY CLASS. *(of this report)*: UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*
Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES
Available in Defense Documentation Center

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*
Environics
Environmental Impact Assessments
Environmental Protection

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*
This report provides instructions for Air Force field personnel in the methods for preparing Environmental Assessments. The report covers the following areas:

a) The necessity for Environmental Assessments, including a discussion of the applicable laws.
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cont. b. (2) Instruction on how to describe the proposed action.

c. (3) Guidance on how to evaluate the environment in light of the proposed action.

d. (4) Instruction and guidance on approaches to be used when assessing impacts.

e. (5) Establishing and maintaining an environmental baseline data information system.

The report is written for a person with a technical background, but without experience in environmental analysis. It provides "how-to-do-it" guidance for field personnel who are assigned the responsibility of preparing Environmental Assessments. This report is a companion document to AFCEC-TR-75-23, A Methodology for Preparing Environmental Statements.

PREFACE

This report was prepared by Arthur D. Little, Inc., Cambridge, Massachusetts 02140, under Contract Number F29601-74-D-0027, Call Order Number 007, Job Order Number 21033E25, with the Air Force Weapons Laboratory, Kirtland Air Force Base, New Mexico. This report summarizes work done between March 1975 and November 1976 and is a companion document to AFCDC-TR-75-29, A Methodology for Preparing Environmental Statements. Captain Donald J. Armstrong, Jr. (AFCEC/EVP) was project officer.

This report has been reviewed by the Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be available to the general public, including foreign nations.

This Technical Report has been reviewed and is approved for publication.

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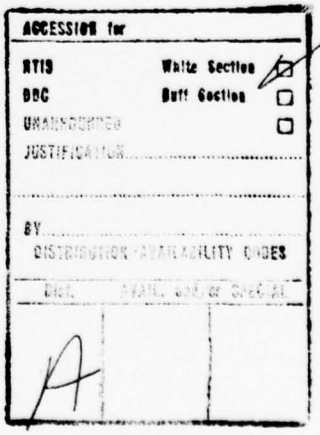

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TABLE OF CONTENTS

A METHODOLOGY FOR PREPARING ENVIRONMENTAL ASSESSMENTS

TABLE OF CONTENTS (CONTINUED)

A METHODOLOGY FOR PREPARING ENVIRONMENTAL ASSESSMENTS

TABLE OF CONTENTS (CONTINUED)

A METHODOLOGY FOR PREPARING ENVIRONMENTAL ASSESSMENTS

SECTION I

INTRODUCTION

1.1 PURPOSE AND SCOPE

The Air Force must insure that all actions are planned, initiated, and carried out in a manner to avoid adverse effects on the quality of the human environment. Therefore, it is essential the environmental consequences of any proposed action be assessed to insure that they are consistent with the national policy on environmental protection. It is also essential that methodologies be established which will promote the orderly and timely assessment of environmental consequences and alternative actions at the field level, and that these environmental documents must convey the information effectively for review and planning purposes.

The purpose of this technical report is to provide guidance to field personnel at Air Force installations for the preparation of environmental assessments covering operations, construction of new facilities, and other actions that may cause significant impacts to man's environment. This report includes guidance on the methods to be used in preparing the assessments, recommendations governing environmental baseline data and information, and guidance about how this data and information can be obtained and managed.

1.2 THE ENVIRONMENTAL ASSESSMENT PROCESS

The purposes of Public Law 91-190, The National Environmental Policy Act of 1969 (NEPA), are to declare a national policy that will encourage productive and enjoyable harmony between man and his environment; to promote efforts that will prevent or eliminate damage to the environment and biosphere and that will stimulate the health and welfare of man; and to enrich the understanding of ecological systems and natural resources that are important to the nation.

To administer this Act, the law provided for the establishment of the Council on Environmental Quality (CEQ) in the Executive Office of the President. The law also provided that actions involving federal funds or regulatory processes or which were of a federal administrative nature, and which could cause significant impacts on the environment, should be investigated to determine the extent of such impacts, and that alternatives to the proposed actions should be investigated. The mechanism for reporting such investigations is the Environmental Impact Statement (EIS). The environmental assessment is a precursor to the EIS.

The responsibility for conducting environmental studies has been delegated to the various government agencies. For the Department of the Air Force, environmental protection policy and responsibilities are established in AFR 19-1. Guidance for the preparation of environmental assessments and statements are contained in AFR 19-2. These regulations should be reviewed in conjunction with the use of this report.

Practically any action undertaken by the Air Force can be expected to have some impact on the environment. However, only some of these actions will cause impacts which can be classified as significant and for which a formal environmental impact statement will have to be prepared. The environmental assessment is the process by which the environmental effects of proposed actions are initially identified by the unit responsible for the project. It also serves to identify actions for inclusion and analysis throughout the decision-making process. The assessment indicates environmental values that need more detailed study, or that no additional environmental reviews are necessary. Items identified as potential problem areas must be evaluated fully and their detrimental effects anticipated. The various alternatives available to eliminate or mitigate the potential problem, if any, must be included. The assessment will be used by the commander when making a decision. All assessments are made a matter of record until the action is completed, even though most environmental assessments will not lead to environmental statements.

Assessments should be complete and comprehensive because some projects or actions which may not initially seem to cause significant impacts may subsequently result in significant adverse impacts and/or may become controversial. In this event, the assessment document may be subject to review or even subpoena if litigation is involved. It is essential that the assessment report show that a complete and comprehensive evaluation was made at the time the assessment analysis was performed.

The types of actions that require the preparation of formal environmental assessments are listed in Attachment 1 of AFR 19-2. It should be noted that this list refers to a variety of types of actions. However, it may be appropriate for several actions to be considered jointly for assessment purposes, or for the cumulative effects of a single action that is repeated over a long period of time to be considered for these cumulative effects rather than their individual impacts. In these cases, it will be necessary to assess their potential impacts on a programmatic basis, that is, the impacts resulting from the entire program rather than separate assessments for each part of the program. This approach should also be used for continuous actions involving similar events, such as the use of a test center or range. A logical time frame should be used for each such continuing assessment. Assessments for continuous actions should be reviewed and updated annually to reflect anticipated changes in the coming year's activities.

1.3 RESPONSIBILITY FOR ENVIRONMENTAL ASSESSMENTS

The responsibilities for the preparation of environmental assessments and statements are established in AFR 19-1. In general, each major command and separate operating agency is responsible for the preparation of environmental assessments for projects and actions within its jurisdiction.

SECTION II

THE RELEVANCE OF FEDERAL ENVIRONMENTAL LAWS AND REGULATIONS

2.1 INTRODUCTION

The performance of environmental assessments is directly related to the National Environmental Policy Act of 1969 (NEPA). However, the regulations established by the CEQ (AO CFR 1500, Section 1500.8, Content of Environmental Statements) requires an evaluation of the relationship of the proposed action to land use plans, policies, and controls for the affected area. These controls include those developed in response to the Clean Air Act or the Federal Water Pollution Control Act Amendments of 1972. These requirements are also stated in AFR 19-2, Attachment 2. In addition, Executive Order 11752 requires that heads of federal agencies insure that all facilities under their jurisdictions be designed, constructed, managed, operated, and maintained so as to conform to federal, state, interstate, and local environmental laws and regulations.

It is therefore necessary as part of the assessment process to determine whether the program or action will involve any activities that are regulated or controlled by these environmental laws. The principal federal environmentally-related laws are listed in Table 1. Brief summaries of these laws and their principal subject matter follow.

TABLE 1. FEDERAL ENVIRONMENTAL AND ENVIRONMENTALLY-RELATED LAWS

National Environmental Policy Act of 1969 (NEPA)
Clean Air Act Amendments of 1970
Federal Water Pollution Control Act Amendments of 1972 (FWPCA)
Noise Control Act of 1972
Fish and Wildlife Coordination Act (1958)
Anadromous Fish Conservation Act of 1965
Estuarine Areas Act of 1968
Marine Protection, Research and Sanctuaries Act of 1972
Wildlife Restoration Act
Migratory Bird Conservation Act
Endangered and Threatened Species Preservation Act of 1973
Marine Mammal Protection Act
Migratory Bird Treaty Act
Bald Eagle Protection Act
Lacey Act
Black Bass Act
Federal Insecticide, Fungicide and Rodenticide Act
Federal Environmental Pesticide Control Act of 1972
Food, Drug and Cosmetic Act of 1970
Occupational Safety and Health Act of 1970 (OSHA)
Poison Prevention Packaging Control Act of 1970
Federal Hazardous Substances Act
Solid Waste Disposal Act of 1965
Resource Recovery Act of 1970
Antiquities Act of 1906
Historic Sites Act of 1935
National Historic Preservation Act of 1966
Coastal Zone Management Act of 1972

2.2 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA)

This Act establishes a national policy requiring all federal agencies to give full consideration to environmental effects in planning and carrying out their programs. To ensure that the agencies comply with this policy, NEPA prescribes the preparation of detailed statements of environmental impact on every major federal action that might significantly affect environmental quality. The statement must discuss alternatives to the proposed action and must be circulated to other federal agencies for their comments.

2.3 CLEAN AIR ACT AMENDMENTS OF 1970

This Act is administered by the Environmental Protection Agency (EPA) with regulatory responsibilities granted to the states. National primary and secondary standards were established by the EPA for six major air pollutants--sulfur dioxide (SO_2), particulate matter, carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x), and photochemical oxidants. These standards, which apply to both stationary and mobile sources, became the basis for the development of state implementation plans (SIPs) under which polluters are required to install control technology or take other steps so that emissions are reduced to levels which will permit ambient air quality standards to be achieved. The law also requires that new plants, or existing plants undergoing major modifications, and certain mobile sources, meet performance standards. Air quality is monitored within 247 Air Quality Control Regions (AQCRs) in the U.S., some of which have inter- or multi-state status. The Act also regulates throughout the U.S. all emissions which could have an adverse effect on public health and welfare. Such hazardous substances include asbestos, beryllium, and mercury.

2.4 FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 (FWPCA)

The FWPCA, administered by EPA, regulates discharges of pollutants from point sources, including industrial plants, municipal sewage treatment plants, and agricultural feedlots, as well as from spills of oil and other hazardous substances. Discharges are subject to effluent standards designed to implement by 1 July 1977, best practical control technology currently available, and best available by 1 July 1983. Dischargers must also observe water quality standards which relate to receiving waters. Toxic and thermal discharges are also controlled, as are dredging and filling in navigable waters.

2.5 NOISE CONTROL ACT OF 1972

The Noise Control Act of 1972 establishes EPA as the center of responsibility for federal anti-noise efforts, and applies to noise emission characteristics of products distributed in commerce. (Note: Noise levels as perceived at property lines are generally regulated by local ordinances.)

2.6 WILDLIFE PRESERVATION ACTS

Several laws deal with the preservation of wildlife. The Fish and Wildlife Coordination Act (as amended, 1958) provides that whenever the waters of any stream or other body of water are to be controlled or modified by federal actions or under federal permit or license, the controlling or modifying agency first shall consult with the U.S. Fish and Wildlife Service and with the head of agency exercising administration over the wildlife resources of the particular state with a view to the conservation of wildlife resources by preventing loss of and damage to such resources. If the work is performed by the federal agency, appropriate mitigating actions must be taken.

The Anadromous Fish Conservation Act of 1965 and the Estuarine Areas Act of 1968 empower the Secretary of the Interior to enter into agreements with states for protection of these resources. The Marine Protection, Research and Sanctuaries Act of 1972 deals in two of its three titles with ocean dumping of wastes and other matters, and it is popularly known at the Ocean Dumping Act. It empowers the Secretary of Commerce to designate marine sanctuaries in which no dumping or similar disturbing action may occur.

Other acts dealing with wildlife conservation include the Wildlife Restoration Act, the Migratory Bird Conservation Act, the Endangered and Threatened Species Preservation Act of 1973, the Marine Mammal Protection Act, the Migratory Bird Treaty Act, the Bald Eagle Protection Act, the Lacey Act, and the Black Bass Act.

2.7 ACTS CONCERNING PESTICIDES

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) was enacted in 1947 to regulate the shipment of pesticides in interstate commerce. This Act was amended by the Federal Environmental Pesticide Control Act (FEPCA) of 1972. FEPCA retains and strengthens the labeling requirements of FIFRA, and establishes new federal powers of pesticide regulation, including authority to proceed against persons or individuals who engage in pesticide use in a manner "inconsistent with its labeling." The Act classifies pesticides into two categories: general and restricted use products. Pesticides in a restricted use category become subject to special controls and may be applied only to trained operators. Federal authority extends to the use, shipment, distribution, and sale of all pesticide products, both interstate and intrastate. The Act also obligates the government to establish procedures for disposal of pesticide containers and excess pesticides.

Other federal acts involving pesticides are the Food, Drug and Cosmetic Act (FDCA) of 1970 that sets forth procedures under which pesticide tolerances are set both for raw agricultural commodities and for processed food; the Occupational Safety and Health Act (OSHA) of 1970 under which standards of exposure levels for agricultural and other workers using pesticides are established; the Federal Water Pollution Control Act Amendments of 1972 and Clean Air Act that deal with pesticides in water and air; the Poison Prevention Packaging Control Act of 1970; and the Federal Hazardous Substances Act.

2.8 SOLID WASTE AND RESOURCE RECOVERY ACTS

The management of solid wastes is not regulated by the federal government, but there are two laws that relate to this issue. The Solid Waste Disposal Act of 1965 provides for federal grants and assistance for the promotion of new technologies, improved management systems, personnel training, and state and regional solid waste planning. The Resource Recovery Act of 1970 (which amended the Disposal Act) is intended to promote the recovery of resources contained in solid wastes, including both materials and energy, to provide national disposal sites for the storage of hazardous waste, and to reduce the quantity of solid wastes through such measures as recycling and changes in the methods of production and packaging.

2.9 ACTS CONCERNING THE CULTURAL ENVIRONMENT

Several acts pertain to the preservation of historic landmarks, historic and prehistoric structures, and other objects of historic, cultural, or scientific interest. These acts include the Antiquities Act of 1906, the Historic Sites Act of 1935, and the National Historic Preservation Act of 1966. The latter adds the term "culture," in addition to historical and archaeological, to identify those aspects of the nation's heritage worthy of protection. It also provides for the listing of historic and cultural resources in a National Register of Historic Places. Executive Order 11593 furthers the policies in the Acts by expanding federal agency duties and responsibility for both federally-owned and non-federally-owned cultural properties.

2.10 COASTAL ZONE MANAGEMENT ACT OF 1972

The 1972 CZM Act is a federal land use law that applies to coastal zones. It establishes a voluntary program in which all 30 coastal states and 3 of the 4 territories have chosen to participate. Its chief purpose is to encourage the states to balance needs and make deliberate choices among the claims on coastal resources. Federal grants help the states to develop their plans. The law pledges the U.S. government to abide by state programs for managing coastal resources. The Secretary of Commerce may reject state programs but once such programs are approved, the federal government must make its own actions consistent with them, so far as practicable. The Act also supports state efforts to preserve wetlands and estuaries by providing a joint federal-state program, including funds for matching state grants, to establish estuarine sanctuaries.

SECTION III

ENVIRONMENTAL CONSIDERATIONS IN THE PLANNING OF AIR FORCE ACTIONS

3.1 UNDERSTANDING OF ACTION; DEFINITION OF THE ACTION

The term "action" as applied to environmental assessments and statements can have several meanings. It can include administrative procedures, construction of new facilities, the operation of a base,

training exercises, or the testing of new weapons. The action is therefor the event or activity that will happen and which may impact man's environment.

Some actions are easy to identify because they are relatively large single events having one principal objective that can be readily defined. An example is the construction of a new power plant. Other actions present problems in definition because they are part of larger scale activities, or they may involve multiple events or complex objectives. For example, the operation of a test facility involves numerous tests, including different tests of the same components and many tests during the year of different components. Each individual test can be considered as an action, as can a series of tests on one component, or the operation of the entire testing facility for a period of time such as a year.

However it may be decided to classify an action for environmental assessment purposes, it should be remembered that the intent of NEPA is to introduce environmental considerations to the planning process. The environmental assessment should be made as soon as possible when actions are being planned so the potential impacts can be included in the decision-making process that is involved in the approval, disapproval, or modification of the planned action. At the same time, the assessment cannot be fully comprehensive until the planners have sufficiently defined the action and its likely consequences.

In describing the action, all of its related or associated events must be included. Such events include, but are not limited to, construction, operation of the activity, and post-operational disassembly and clean up. The methods for describing the action are discussed in detail in Section IV.

3.2 THE ENVIRONMENT

The environment is literally the sum of man's surroundings, making it a large and complex thing to analyze. To bring some sense of order to this task, one can classify the environment into principal categories and subsets. The three principal categories are the physical, biotic, and human environments. The physical environment includes three subsets, those for air, land, and water. The biotic environment is classified as representing all living things except man. Subsets of the biotic environment include plants, animals, their habitats, and ecology. The human environment represents man's activities; his living, working, and recreational actions and associated facilities, and his works both past and present. The various components of the environment are discussed in more detail in Section V.

3.3 ENVIRONMENTAL IMPACTS

An environmental impact is any change to any component of the environment as a result of an action. Impacts can range in magnitude. Impacts directly related to the action (generally in the sense of location and time) are called direct or primary impacts. The control or moderation of their effects is generally an obligation of the party responsible for the

action. Impacts indirectly related to the action, which may occur at remote locations or at a later time, or which influence systems of which the action was a part, are called indirect or secondary impacts. While such ripple effects can continue into tertiary or higher order impacts, all non-primary impacts are generally referred to as secondary impacts. Control of the magnitude of secondary impacts often resides outside the obligation or authority of the party responsible for the action.

In analyzing impacts, one must first identify them in a qualitative sense, and then quantify them to the extent possible. Both adverse and beneficial impacts should be included in an assessment report. In some cases, an impact may be beneficial to one segment of the environment but detrimental to another.

Since the assessment concerns the anticipated impacts of a future action, there is not always a simple way to identify or measure the impacts. The existing environment must first be defined using existing data bases. The data must then be projected to reflect future conditions under the assumption that the action does not occur. These sets of projections represent the baseline environmental condition from which net environmental impacts can be measured. The sets of projections must then be revised to reflect best estimates of future conditions under the assumption that the action does occur. The difference between the action and no-action projections represent the impacts.

The sets of projections must include all aspects of the environment which may be affected by the action, e.g. air quality, water supply, wastewater discharge, and socioeconomic factors. Accomplishing this work will require the use of a multi-disciplinary team, particularly for developing projected conditions. The extent to which such a team must be used will, of course, depend on the nature and magnitude of the proposed action.

There are several methods to assess environmental impacts. These are discussed in more detail in Section VI.

3.4 THE IMPORTANCE OF FULL DISCLOSURE

When an environmental assessment is made, all aspects of the action and their probable effects on the environment must be disclosed. If any parts of the action or the assessment involve classified information or data, they should be reported in a separate document with proper security classification.

The basic reason for full disclosure is not that the law requires it, but that an incomplete assessment, by definition, is not comprehensive. Without full disclosure, it is not possible for higher command to determine correctly whether impacts should be classified as minor, resulting in a negative declaration being filed, or as significant and therefore requiring a formal environmental impact statement. Furthermore, an incomplete report does not provide a commander with a true description of the probable impacts of a decision he may have to make. The assessment report also serves as a record that the planning for the proposed

action included the proper environmental investigation. To this extent, the assessment may preclude litigation to halt the action on the basis of failure to properly and fully consider the environmental impacts as required by NEPA.

SECTION IV

HOW TO DESCRIBE THE ACTION

4.1 INTRODUCTION AND OBJECTIVE

The description of the action gives the reviewer of the assessment report one part of the information needed to independently evaluate the potential environmental impacts. Physical, social, economic, by-product (including waste), and abnormal event descriptions of the proposed action must be given. The opening paragraph should provide a brief general description and state the objective of the action.

4.2 PHYSICAL ASPECTS OF THE ACTION

4.2.1 Physical Description

If the action involves the construction of a facility (e.g., a building, tower, road), describe its general shape and dimensions, construction material, appearance, and its intended function. If the action involves tests, describe them in general terms (e.g., for explosives, the type and size of individual charges). If the action involves training exercises, give the number of personnel involved and provide a general description of the activities that will be involved.

4.2.2 Ancillary and Support Elements

These should also be described if they will be required as part of the basic action. For example, the construction and operation of an offshore radar platform would require supply vessels; these in turn would require harbor and docking facilities. The ancillary and support facilities need only be described in detail if they constitute a new and potentially significant action that supports the basic action.

4.2.3 Action Duration and Frequency

Some actions have a long-term impact duration, for example, the construction of a new runway. However, the operational use of the runway may be different if the frequency of its use is limited. Other actions may have a short, active duration, although the impacts may remain for a long time (e.g., the clearing of mature trees to facilitate a test lasting only a few months). The action duration and frequency of separate events that are part of the action must therefore be described in order for the impacts to be properly evaluated. If the duration and frequency cannot be well defined in advance, this should be stated and best estimates of their values given.

4.2.4 Site Requirements and Location

The area required for the action should be given (generally in acres) as well as its location. The latter should include state, county, and municipality. It is helpful to give the name of the USGS quandrangle map that covers the location and to include a copy of that portion of the map that shows the action site. Latitude and longitude can also be used to pinpoint the location of the action.

4.2.5 Air Space Requirements

If the action involves the use of aircraft, and if it will require the need for a restricted air space zone, these requirements should be described, including the space to be restricted or reserved.

4.2.6 Pre-Action Preparation and/or Construction

These should be described if they are liable to create impacts by themselves. For some actions, such as the construction and operation of an underground pipeline or cable, the construction phase is most likely to cause impacts since there is little evidence of their presence once construction is completed. Similarly, if a test requires the clearing of large areas of vegetation, this clearing and the disposal of trees and shrubs can have a more significant impact than the tests themselves.

4.2.7 Post-Action Cleanup

This phase, if proposed, should be specifically stated and described since long-term impacts can vary considerably depending on the post-action treatment of the site. In particular, note whether solid waste will be collected, whether potentially harmful material will be neutralized, and whether scarred landscape will be replanted.

4.3 SOCIAL ASPECTS OF THE ACTION

These aspects are represented by the transfer of large numbers of personnel which affect the housing situation in a community or at a base. Hospital, school, transportation, and recreation facilities may also be affected. Obviously, these types of social impacts would occur if the nature of the action involved large numbers of people. They could also occur if the action involved relatively few personnel at small and remote installations.

Therefore, key items to be described under the social aspects of an action are the number of personnel involved and any special supporting services they may require from the community. If the extent of these services is small compared to resources available in the community, the description can be very brief; however, if the services to be supplied are relatively large, they should be described in detail and quantified to the extent possible.

4.4 ECONOMIC ASPECTS OF THE ACTION

The action can have economic impacts on the local community if it affects the tax structure or the need for services, or if it results in additional money becoming available for spending. If a significant addition or reduction of personnel is involved, the housing market and sales in local stores could cause an economic impact on the community. If local civilians are to be employed (particularly for initial construction), this could affect the employment situation. If significant quantities of building materials or local supplies and services are to be purchased, these also can affect the local economy.

The aspects of the action which may have economic effects should be identified, and an estimate should be made of the financial impact and what percentage of the local economy it involves. If such impacts are not expected to be significant, then a statement to this effect should be made. Economic impacts are both direct and indirect. The former are those directly associated with the action, while the latter are represented by the multiplier effect. For example, the money paid to a contractor to construct a new facility is in turn spent by him for materials, supplies, and wages. These monies are in turn re-spent, thus resulting in a total economic impact that is considerably larger than the direct expenditures alone.

4.5 BY-PRODUCTS OF THE ACTION, WHICH ALSO MAY CAUSE IMPACTS

4.5.1 General

The operational phase of an action (and to some extent the construction phase) usually involves the input of supplies and energy, their use and transformation, and finally the disposal of the waste products to the environment. The disposal of these by-products can affect the environment. Therefore, these by-products must be described qualitatively and quantitatively if they will occur in significant amounts. Devices used to control emissions should also be described.

In the sections below, the principal types of emissions are described. However, not all potential emissions are included, nor are all of the potential problems associated with emissions covered. The investigator should be alert for special or unique situations that could cause problems.

4.5.2 Atmospheric Emissions

Primary and secondary standards have been established for six substances (particulates, NO_x, SO_2, hydrocarbons, and photochemical oxidants). These are used for determining air quality under the Clean Air Act. Photochemical oxidants are secondary pollutants created *in situ* and are not emissions. If the action involves increases in ambient levels of any of the substances, the quantity should be determined and an estimate should be made of the impact on the local and regional air quality. Other atmospheric emissions must be considered if they are potentially toxic or hazardous. The following brief comments are intended to convey some representative problems that may occur.

4.5.2.1 Particulates--These result from combustion (smoke), from construction activities (dust), and from operations involving fine materials, such as the loading or bagging of powder, cement, etc. Controls include bag filters, electrostatic precipitators, after-burners and scrubbers or, in the case of construction, the application of water or calcium chloride or oil. Use of calcium chloride or oil results in a future impact to surface and ground water as a result of precipitation.

4.5.2.2 NO_x--Nitrogen oxides can result from the detonation of explosives or from a furnace or combustion engine operating at high temperatures causing combination of the nitrogen and oxygen present in the atmosphere. They are visible from explosives in the form of a reddish-brown gas.

4.5.2.3 SO_2--Sulfur dioxide is caused by the combustion of fuels containing sulfur in the presence of oxygen. Estimates of quantities can be made if the sulfur content of the fuel is known. Control is effected by burning low sulfur fuels or, in the case of power plants, by the use of scrubbers.

4.5.2.4 CO--Carbon monoxide is caused by the incomplete combustion of fuels. Controls include proper maintenance of furnaces or engines and the use of catalytic converters in the case of automobiles.

4.5.2.5 Hydrocarbons--This group includes many organic compounds involving hydrogen and carbon. Hydrocarbons are important primarily because of reactions they undergo in the atmosphere, which produce many irritating compounds. Because methane is generally not reactive in the atmosphere and is found in relatively high natural concentrations, it is excluded from measurements and standards. The most important sources of hydrocarbons are fuel storage and transfer operations. Vapors escape to the atmosphere when a tank is re-filled and as the result of the tanks "breathing," because of atmospheric pressure and temperature changes. Another source is the exhaust from hoods used to ventilate cleaning operations.

4.5.2.6 Photochemical Oxidants--These result from the interaction of sunlight with hydrocarbons and nitrogen oxides in the atmosphere. The common measure of these oxidants is ozone. Because of the time lapse required for the reaction to occur, the photochemical oxidants may be greatest at tens or even hundreds of miles downwind of the source of the reactive gas released, after the sunlight has had an opportunity to cause the chemical change.

4.5.2.7 Potentially Toxic or Hazardous Substances--These include a wide variety of substances. Substances sprayed for pest and vegetation control as part of the action should be described by type, formula, and amount and frequency of application. Dust that could include asbestos fibers, or dust vapors from elements or compounds known to be toxic or hazardous should also be described.

4.5.2.8 Other Elements or Compounds--The list of substances that can cause air pollution is already extensive and it grows constantly as new research identifies problem substances. One item to consider is odors, if they can reach populated areas. Control may be possible if the release of noxious odors can be made to coincide with wind directions away from areas of populations.

4.5.3 Liquid Wastes

Liquid wastes are discharged to the environment in two forms: those that are discharged at a point source, generally as a result of having been collected in a pipe or ditch system; and those that are discharged over a wide area, termed non-point source discharges. Examples of the former are sewer and drainage systems, while the latter include overland runoff of precipitation as well as infiltration of surface water to ground water. The ground water may eventually reach streams and rivers as bank seepage.

Point sources are capable of being treated to remove or reduce pollutants from the water that serves as the vehicle for transporting them. Sewage and industrial waste treatment plants are examples. However, treatment plants are only capable of treating certain pollutants. If the waste being discharged into a liquid collection system contains chemicals or impurities not commonly discharged, a check should be made at the treatment plant to determine whether these wastes will be removed by the treatment process. The assessment report should indicate the total quantity of waste to be discharged, its composition (including chemical names), and the rate of discharge. Estimates should also be made of the concentration of the pollutant that will eventually be discharged to a river or stream.

Non-point source discharge is more difficult to quantify. Some levels of treatment can be made by use of settling basins to remove suspended solids in surface flows. Soil acts as a filter for some polluting substances and as a retainer of chemicals as a result of ion exchange capture. If fertilizers, pesticides, or herbicides are spread, they may be washed into streams or leached into the ground. The assessment should describe the types and quantities of potential pollutants being spread, the rate and frequency of application, the nature of the soil and terrain, and the depth to the ground water table.

Some of the more common pollutants that are contained in liquid wastes are discussed briefly below.

4.5.3.1 Sewage Wastes--Measured parameters include BOD (biochemical oxygen demand, an empirical test used to determine the relative oxygen requirements of wastewaters, effluents, and polluted waters), dissolved and suspended solids, oil and grease, pH, and bacteria (usually E coli, a measure of the potential presence of harmful bacteria and disease-carrying viruses). Since laboratory sinks and floor drains often discharge directly to the sanitary sewer system, check for the possible disposal of chemicals that could upset the balance of the treatment plant or which may not be capable of being treated. Excessive nutrients

(nitrogen, phosphorus, potassium) can also create problems since they cause excessive algae growth in the receiving waters.

4.5.3.2 Petroleum--Oil, gasoline, and grease can enter the aquatic environment as a result of accidental spills or from washing down of parking aprons or garage floors. If the action involves the storage or use of significant quantities of petroleum products, identify this as well as the implications of an accidental spill. The latter includes the ability of the spill to enter water courses, and protective features such as dikes or oil skimmers provided to minimize the impacts of such spills.

4.5.3.3 Potentially Toxic or Hazardous Substances--This class of pollutants can create severe impacts to the water environment, particularly if the substances are not readily degraded and if they can pass through the food chain (e.g., plankton to fish to humans). If the water to which the pollutants are being discharged forms part of a water supply system (whether surface or ground water), note any substances that may impair the quality of the water as a drinking source. If such substances are involved in the action, they should be identified in the assessment in qualitative and quantitative terms, and measures to be used to prevent their release and to monitor the water environment should be described.

4.5.3.4 Other Waste Products--There are many other pollutants that can enter water resource systems as a result of various activities. One example is the increase in chloride ions as a result of salting of roads in the winter. Another is silt and finer suspended solids from runoff during construction activities. The latter can be controlled by use of settling basins and/or straw filters. Hot water (e.g., from power plants or cooling devices) is also a pollutant in the sense that temperature of water bodies is a major characteristic of their ecosystem and any disturbance to that system is a pollutant. Thermal pollution should be described in terms of quantity and temperature of pollutant, and temperature and flow of the receiving body.

4.5.4 Solid Wastes

Solid wastes can be generated during construction, operation, and cessation of an activity. Disposal of these wastes may be by incineration, burial in a sanitary landfill, or in some form of open dumping. The latter includes spoil piles used for excavated rock or earth. If the solid wastes are not voluminous and/or if they can readily be handled by existing solid waste disposal systems, the impacts are probably not significant. However, if their volume would cause a burden on existing systems, or if no collection systems are available, the type of solid wastes, their volume, and the method for their disposal should be explained in the assessment report.

4.5.5 Radioactive Wastes

If the activity includes the use of radioactive materials, the type and quantity of material should be described as well as precautions to be taken in its handling and methods for disposal, if applicable. This includes minute quantities that may be involved in laboratory tests (e.g., tracers), and radioactive materials found in operating components

such as microwave tubes. Radioactive material may also be found in activities involving medical research and in hospital operations.

4.5.6 Electromagnetic Radiation

This covers the entire band of electromagnetic radiation including radio, radar (microwave), heat (infrared), visible light, ultraviolet, and X-rays. The direct impacts of these emissions are generally well known and should be described briefly in the assessment. However, some of the indirect impacts may be overlooked unless a careful evaluation is made. For example, the illumination of large areas at night may interfere with astronomical observations; the construction of a metallic building or tower may create adverse radar reflections; the presence of microwave radiation may affect pacemaker heart devices; or the transmission of shortwave radio radiation may induce currents in wires used for construction blasting. The assessment report should identify the types of electromagnetic radiation that will be emitted by the action, their energy levels, their potential impacts, and any measures that will be used to minimize the impacts.

4.5.7 Noise

Noise pollution is receiving increasing attention as an adverse environmental impact. The assessment report should identify the sources of the noise, the expected loudness (in dBA, at a specified distance from the source), the frequency distribution (e.g., broad band; generally low-, medium- or high-pitched; and whether there are peaks at a particular frequency), whether the noise is continuous (e.g., from a motor) or intermittent (e.g., from explosives), and the frequency and time of day at which the noise will be generated. The report should also give measures to be taken to minimize the noise output, and the distance to population centers that may be affected by the noise. Some specific considerations follow.

4.5.7.1 Shock Waves-Sonic Booms--These are principally caused by aircraft flying at speeds greater than sound. If such flights are likely to occur in a studied area, the location, altitude, frequency of occurrence, and the duration of the flights should be reported, as well as the populated area that will experience the shock waves.

4.5.7.2 Aircraft Noise--Aircraft noise can be a problem from low level flights and from engine testing pads or cells as well as from take-offs and landings. If an action involves any significant increase in aircraft noise, it should be described by giving the source (type of aircraft or engine), location, the frequency and duration. Noise generated at night is of particular concern. A copy of a USGS topographic map can be submitted to show the location of the noise relative to population centers. Noise contour maps (AICUZ) should be considered.

4.5.7.3 Delivery Systems and Ordinance--If the noise from the testing of these systems is generated at locations normally used for such purposes, this should be stated and it then may be assumed that no new significant impacts will occur from the noise. However, if the action will cause new

or unusual noise, the assessment report should describe the nature of the noise and the potential impact on the local environment.

4.5.7.4 Support and Ancillary Equipment--Examples of these noise sources are electrical generators, compressors, air conditioning equipment, and vehicular traffic. The potential impact of such noise sources will depend on the change in ambient noise levels in the area, and on the population that may be affected.

4.5.8 Tabular Quantification of Action By-Products

To assure all potential action by-products have been assessed, it is useful to prepare a tabular listing similar to that shown in Table 2. The listing of by-products can be modified or expanded to reflect the types of emissions that are characteristic of a particular installation or test range. The table can include columns for entering the quantity of the by-product that will be emitted, the potential significance to the environment, and the source of the information.

The purpose of the table is to identify any data gaps, and to provide evidence that all potential emissions were assessed. It should not be used, however, as a substitute for the assessment report.

4.6 POTENTIAL FOR ABNORMAL EVENTS AND IDENTIFICATION OF POSSIBLE EFFECTS

An assessment of the potential impacts of an action must consider all significant impacts that may occur. The preceding discussion has dealt with the impacts that are associated with the normal operation of a project. However, experience has shown that, despite the best plans, designs and operational methods, accidents or abnormal events do occur. For some actions, the most severe adverse impacts are those associated with such abnormal events. An example is a casualty to a large crude oil tanker, with subsequent damage to marine life and beaches from the spill.

The quantitative analysis of abnormal events can be a lengthy and complex process, involving the identification of potential abnormal events by the development of an "event-tree;" then determining the probabilities that each event will occur and their severity; then assessing the impacts of each event.

If the action does not warrant a detailed analysis of potential abnormal events, the subject may be covered by a reasonable qualitative discussion of the potential abnormal events that could be associated with an action and the potential environmental impacts. For example, if the action involved the construction of a new oil storage tank, the reviewer would want to know where the oil would go if the tank ruptured. If it were contained and could be cleaned up, the potential impacts would not be considered severe. Alternatively, if it flowed into a stream or water supply system, the impacts could be significant.

TABLE 2. ACTION BY-PRODUCTS INVENTORY

Type of By-Product	Quantity	Significance	Source
Atmospheric Emissions			
Particulates:			
Smoke			
Construction Dust			
Processing Dust			
NO_x			
SO_2			
CO			
Hydrocarbons			
Methane			
Other			
Photochemical Oxidant Potential			
Pesticides			
Herbicides			
Odors			
Toxic/Hazardous Substances			
●----------			
●----------			
Other			
Liquid Wastes			
BOD			
Dissolved Solids			
Suspended Solids			
pH			
Oil, Grease, Scum			
Bacteria			
Nutrients			
Heat			
Toxic/Hazardous Substances			
●----------			
●----------			
Other			
Solid Wastes			
Trees, Brush			
Soil, Rock			
Packing, Shipping Material			
Paper, Wood			
Glass			
Metal			
Grease, Paint			
Garbage			
Other			
Energy			
Radioactive Material			
Radio Frequency Radiation			
Radar			
Infrared, Heat			
Visible Light			
Ultraviolet			
X-rays			
Noise:			
Aircraft			
Other			

The discussion of abnormal events should also include a description of preventive and protective measures that are or will be made available. Preventive measures are intended to prevent the abnormal event from happening (e.g., radar as a navigational aid), while protective measures are intended to minimize adverse effects after the event has occurred (e.g., spill cleanup equipment).

The assessment of abnormal events should consider the potential severity in terms of the safety of operating personnel and protection of the general public, both with respect to short-term and long-term effects. The latter include the accidental release of hazardous or toxic materials, particularly those that are persistent, i.e., do not degrade by the action of nature, and which are difficult to recover or neutralize.

SECTION V

EVALUATION OF THE EXISTING ENVIRONMENT

5.1 INTRODUCTION

Environmental impacts are the changes that occur in the environment as a result of an action. In order to assess the impacts, the nature of the action and the condition or status of the environment prior to the time the action was initiated must be known. The data and information required to describe the action were discussed in Section IV. In this section the description of the environment will be examined under three subsets: the physical, biotic, and human environments.

In each case it is necessary to begin by establishing physical and temporal boundaries for each system. These are defined as the limits to which the impacts may extend, in a physically measureable sense. The physical boundaries are measured in acres or miles, and they may vary for different parameters. For example, impacts to the terrain may be very localized, while those to the atmospheric regime could extend downwind for hundreds of miles. The temporal boundaries are measured in time and fall into short-term and long-term categories. In general, short-term impact represents a one-year cycle while long-term effects can extend for hundreds of years. An example of short-term impact is the temporary occupation of a habitat used by migrating birds. Long-term effect is exemplified by the clearing of a climax forest, which would require hundreds of years of successive growth to become re-established in the same form.

5.2 PHYSICAL ENVIRONMENT

The description of the physical environment must include the land, air, and water regimes. The description for assessment purposes should be limited and yet sufficiently comprehensive to provide the reader with an accurate overview. Features that are susceptible to impacts from the action should be described in more detail.

5.2.1 Terrestrial Regime

The topography, soil cover, and the underlying geologic features of the site should be described. The description of the soil should include its general fertility and whether it is used for crops. The dust and erosion potential from both wind and water should also be described. Include a discussion of any mineral deposits in the area, including sand and gravel, ores, rock quarries, and petroleum fields. Any special characteristics of the land, such as earthquake or landslide potential, should also be described if they would be of interest in evaluating impacts associated with the action.

5.2.2 Atmospheric Regime

The information required includes climatological and meteorological data, including mean monthly values for temperature and precipitation, and a discussion of prevailing seasonal weather patterns and storms including hurricanes and tornadoes. For the purpose of air quality analysis, it will be necessary to obtain data which indicate the way pollutants disperse. The diffusion of pollutants is primarily a function of the stability of the atmosphere and wind speed at ground level. The degree of atmospheric stability determines the amount of vertical and lateral mixing of disperson of air pollutants as they are carried away from their source. Atmospheric precipitation and insolation have considerable influence on the diffusion of pollutants, as do mixing depths, inversion frequency, and wind velocity and direction.

The extent to which these data will have to be obtained will depend on the status of the air quality in the air quality control region (AQCR) in which the action is located (e.g., whether any of the national standards are being violated), on the type and quantity of emissions that the action will generate; and on the type of analysis (e.g., dispersion model) that is to be used to quantify the impacts.

The air quality should be described by use of recent monitoring measurements taken by the state or the EPA for the AQCR. These should be cited together with a description of the problem pollutants. The general condition of the air quality in the AQCR should also be described including the air pollution episode potential from a meteorological standpoint. Information can be obtained from the Regional EPA office, state air quality control offices, and from data banks such as NEDS (National Emissions Data System), CAMP (Continuous Air Monitoring Program), and NASN (National Air Surveillance Network).

Another standard for the description of air quality is the significant deterioration classification. Under this system, areas designated Class I are to be maintained in their existing, generally pristine condition with only very minor degradation allowed. This generally applies to wilderness areas and large national parks. Classes II and III are allowed to have progressively more deterioration, but none in excess of the national ambient air quality standards.

5.2.3 Hydrologic Regime

The hydrologic regime is represented by surface water (streams, rivers, lakes, reservoirs, estuaries, oceans) and ground water. Surface water can be described by the location of the water bodies, including the drainage basin from which surface runoff flows to streams and rivers; by the volume of flow, generally in terms of mean monthly discharge, in cubic feet per second; by the storage capacity and surface area of lakes and reservoirs; and by the quality of the water in terms of dissolved oxygen present as well as pollutants. The description of estuarine and ocean waters should include salinity, tidal ranges and currents. Ground water can be described by the mean depth to the water table, the availability of the water from wells (pumping yields in terms of gallons per minute), and the quality of the water.

Most streams and rivers have been classified by sections, known as reaches, according to intended uses. In general, Class A refers to waters suitable for potable water supply, Class B for water suitable for water contact sport, Class C for non-contact sport such as boating, and Class D for navigation or hydro-power only. The classifications also relate to fish habitat and sport and commercial fishing suitability. The stream classifications vary with states. Both the state standards and the classification of streams in the project area should be given in describing the intended quality of the surface waters.

Man-made facilities should also be described. These include reservoirs for water supply and/or flood control or other uses, irrigation systems, and drainage systems, if such facilities will be affected by the proposed actions.

5.3 BIOTIC ENVIRONMENT

The description of the biotic environment includes all living things, plants and animals, with the exception of man. The description must also include the habitats in which they live, any rare or endangered species, and any unique or protected areas and ecosystems.

5.3.1 Vegetation

The general types of vegetation in the area of the action should be described in the assessment, using such descriptors as grassland, shrubs, or forest. The names of the prevailing species and their relative abundance (e.g., 25 percent yellow pine, 50 percent white oak) should also be given. The assessment should indicate whether the plant life in the area of the project is common to the surrounding region, or whether it represents unique or unusual growth. One feature of forests or woodlands is their relative age. An open field can be transformed through successive stages into smaller trees such as birch, poplars, and locust, followed by evergreens such as pines, and finally by large hardwoods such as maple and oak. Each of these stages is called a succession, and the final phase is known as the climax stage.

If the area involves cropland or pastures, the type of crops and use of the land for agricultural purposes should be described. This includes woodland with present or potential use for commercial timbering operations.

5.3.2 Animal Species, Including Rare and Endangered Species

Animal species can be divided into birds, fishes, and land animals. These can be further classified, e.g., song birds, waterfowl, upland game birds, predatory birds, shellfish, finfish, cold and warm water fish, and a variety of mammals. The animals that may exist in the area of the action should be described, and their relative population given, using such terms as "are commonly found" or "are occasionally or rarely seen." Those species that are listed as rare or endangered and which may inhabit the area must be described. Information on such species can be obtained from state departments of conservation or the state wildlife management agency. Some animals which may not be rare or endangered may be on state or federal protected lists and must be described.

5.3.3 Habitats, Unique or Protected Areas, and Ecosystems

The description of habitats and ecosystems follows the description of the plant and animal life in an area. A habitat is the part of the physical environment in which a plant or animal lives. An ecosystem is a functional system which includes the organisms of a natural community together with their environment. These descriptions are intended to show the interdependence and balance in which the biotic systems exist. Particular attention should be given to those subset species that may be affected by the action and how impacts on other species would then occur. For example, if birds are removed from an area, there may be an increase in insects; if foxes are removed, there may be an increase in the animals on which they prey, such as rodents.

5.4 HUMAN ENVIRONMENT

The human environment includes man, his living, working, and recreational facilities, and his cultural heritage. The human environment is complex and contains many subset categories, not all of which may be affected by a particular action. However, the assessment report should identify each category, to show that it was considered by the person preparing the assessment. If the category will not be impacted, the assessment report should contain a brief statement to that effect.

5.4.1 Population, Demography, and Land Use

This information provides background base line data about the area in which the action will occur. Population data should be given for the base or installation, including civilian employees and the number of people living on- and off-base, respectively. The population of nearby communities should also be given. Land use data should include the approximate area (in acres, or percentage of a larger area such as a township or county) that is used for residential, commercial, industrial, agricultural, or other purposes. Unused or vacant land should be included in the report.

Unique or protected areas should also be described if they can be affected by the action. These include stopping places for migrating birds, and trails or watering places used by animals such as deer. If the area is a bird sanctuary or wildlife refuge, the area must be described in detail including the species that are found there.

5.4.2 Human Services

This description should include schools, hospitals, and other services that may be affected by the action as a result of personnel changes that are caused by the action. If there is a short-term influx of personnel (e.g., for construction or for a training exercise), the adequacy of temporary quarters and food services or the special provisions that will be made to meet these needs should be described.

5.4.3 Public Works Facilities

These facilities are represented by the utilities that service both the area in which the action will occur as well as the living areas to be used by personnel associated with the action. There are four categories that should be considered.

5.4.3.1 Water Supply--The action may create demand for additional water supply for three purposes: (1) potable or drinking water, also used for food processing, sanitary flushing, and related purposes (note: potable water is not necessary for flushing but is commonly used for that purpose); (2) processing water, used for industrial types of operations; and (3) fire protection. If the proposed action will create a significant additional demand for water for any of these uses, the available system and its capacitities should be described.

5.4.3.2 Sewer System--This is represented by the collection system of sewer pipes and the treatment plant. If the action will generate significant new quantities of liquid wastes that will be discharged into an existing system, the existing system should be described including the type of treatment that is provided, the types of pollutants it is capable of treating, its design capacity, and its present load. The capacity of the collection system should also be reported if there is any possibility that the system would have to handle flows in excess of its design capacity.

5.4.3.3 Energy Systems--These include electrical supply systems (generating source, transmission lines, and substations), gas lines, fuel oil delivery systems and, in some cases, central heating plants that deliver steam. If air conditioning or cooling systems are involved, they should also be included in the description. The information required includes the availability of the energy supply for the proposed action, and the capability of existing systems to furnish this energy without exceeding their capacities.

5.4.3.4 Communication Systems--These include telephone and telegraph lines and associated switchgear, and radio communications if applicable. If the proposed action will require significant additional communication channels, the capability of the existing systems to provide this service should be described.

5.4.4 Areas of Natural, Scenic, and Cultural Significance

Areas of natural and/or scenic significance include public parks or reservations, wilderness areas, seashores, rivers, and similar locations. They may not be located on or within the area of the action, yet they could be affected by it if the action adds noise or otherwise detracts from the viewing or enjoyment of such areas. For example, the construction of radio or microwave towers on an otherwise undeveloped mountain ridge could detract from its scenic value.

Areas of cultural significance include works of man, generally either historic or prehistoric in an archaeological sense. Historic sites include old buildings, battlegrounds, or even markers that identify a past event that occurred at the site. A listing of such sites is contained in the National Register of Historic Places, and may be supplemented by state and local historical societies' listings. Areas of archaeological interest are generally not evident from an inspection of a site, since they usually involve buried artifacts. The state archaeologist can provide listings of locations that may be of archaeological interest.

The assessment report should identify any areas of natural, scenic, or cultural interest that are located in the vicinity of the project, even if they are several miles away from the area of the action.

5.4.5 Recreation Areas

Recreation areas may be designated or non-designated. Designated areas are those that have been established specifically for recreational use, such as golf courses and swimming pools. They may be on public or privately owned land, and they are characterized by having recreation as their sole or principal use. Non-designated recreational areas are those areas that are partly used for recreation, but have other primary uses. Examples are fields that may be used for hunting, and forests that may be used for hiking or camping.

If the action could affect a designated recreation area, it will be necessary to describe the area in detail, including the type of recreation and the number of users as a function of time (i.e., by seasons, weekends, and days). The alternate locations that would be available for recreation should also be described, and their capacity to absorb the people who would be unable to use the affected area.

The potential impacts on non-designated recreation areas are harder to quantify, since there are generally no statistics concerning their use. Local chambers of commerce, fishing and hunting clubs, and state agencies responsible for natural resources, fish, game, and recreation can often provide useful information. In some instances the action may create recreational opportunities in the form of secondary impacts; e.g., land may be available to the public for hiking or fishing. This is a potential beneficial impact, and any such recreational opportunities should be described.

5.4.6 Transportation

Transportation includes the pathways, vehicles, and appurtenant structures involved in the movement of people and goods. It includes highways, railroads, airports, sidewalks, paths, trains, airplanes, cars, buses, trucks, and pipelines. Some of the principal appurtenances are stations, warehouses, traffic systems, tollgates and bus stops. Transportation systems can be quite complex, and good systems are seldom appreciated until something causes a delay or overcrowding.

If the proposed action will involve any significant amount of transportation services, whether to transport people or materials, the available transportation system should be described, including its estimated design capacity and existing level of use. The typical problems that arise involve added burdens during commuting hours or moderate increases in traffic on small roads. If temporary measures will be involved to minimize anticipated problems (e.g., a new bus stop, temporary parking lot, or traffic control devices), these should be described.

5.4.7 Air Traffic

If the proposed action involves aircraft, and if the flights will be of an unusual pattern or involve large numbers, the existing air traffic situation should be described. The objective is to describe the existing part of the human environment that pertains to private and commercial flights, and the local and regional air traffic control centers, to permit an evaluation of whether the proposed action will disrupt or otherwise burden such existing activities.

5.4.8 Special Considerations

The types of actions undertaken by the Air Force are varied and some can be unusual with respect to potential impacts. Particular attention should be given to actions that could involve large-scale impacts in the event of a major accident. This includes aircraft accidents, both mid-air and ground, and accidents involving explosions or the release of hazardous or toxic materials.

The potential impacts from such accidents should be considered in the assessment, and the area susceptible to the impacts should be described. If the possible accident involves the release of toxic materials into the air or water, the impact area should be described using wind velocity and vector data for air pollutants, and streamflow velocity, volume and current data for water pollutants. If an oil spill in a lake or the ocean is involved, it may be necessary to analyze the trajectory of such a spill in order to determine the locations at which it would reach the shoreline.

SECTION VI

APPROACHES TO ASSESSING IMPACTS

6.1 INTRODUCTION

The environmental assessment of a proposed action involves three steps: (1) the collection of data about the action and the environment in which the action will take place; (2) the evaluations and analyses of this data to determine whether a more detailed study (the environmental statement) is needed, or that no additional environmental reviews are needed; and (3) the documentation of the assessment process in the form of an assessment report.

The types of data that serve to describe the action and the environment were discussed in Section IV and V, respectively. Because of the many data elements involved in these descriptions, it is necessary that the analysis be performed in some systematic manner to assure that all potential impact areas be covered. Three possible methods, the check list approach, the matrix approach, and the narrative approach are discussed below. However, before proceeding with these, some of the attributes of impacts must be defined.

6.2 ATTRIBUTES OF IMPACTS

6.2.1 Objects Being Impacted

The objects that may be impacted are the same set of subjects discussed in Section V. They are the elements that constitute the physical, biotic, and human environments. A change occuring to these elements as a result of the action can be termed an impact, whether it is a change in the quality or quantity of the element, including its distribution in space or time. For example, if the action increases or decreases the flow in a stream, or in the physical or chemical properties of the water, or in the location of the flow, or in the time distribution of the flow, it represents an impact to the hydrologic regime of the stream. Obviously, a single action can impact several of the elements that constitute the environment in any area.

6.2.2 Types and Degrees of Impacts

Impacts can be described in many ways, each of which can aid in evaluating the importance of the impact. The descriptors that follow should be considered in evaluating impacts to individual elements of the environment.

6.2.2.1 Identification/Quantification--Impacts must first be identified as to likelihood of occurrence. This is done from knowledge of the attributes of the action, and judgment and experience with similar past actions. For example, if the action involves the spreading of pesticides or fertilizers on the ground, it is reasonable to assume that they will eventually be leached into the ground water. The next step, which is invariably more difficult, is to quantify the impact. For the example

given, this would ideally involve a determination of the content of the pesticide or fertilizer components in the ground water as a function of time and distance. If a quantitative estimate of the impacts cannot be readily determined, the impact should be discussed in qualitative terms, with attention to potential secondary impacts. Using the same example, this could also include any wells that might be contaminated by the pesticide or fertilizer applications, and the importance of these wells in terms of their use.

6.2.2.2 Direct/Indirect--The direct impacts are usually well defined by most analyses, but the indirect or secondary impacts are often neglected or even omitted entirely. Indirect impacts must be evaluated and described if they are significant. Examples of indirect impacts are the change in a species population as a result of a change in the habitat, i.e., the removal of a forested area, or the increase in air pollutants at a power plant as a result of increases in the demand for electrical energy.

6.2.2.3 Short-Term/Long-Term--Some actions may have different impacts when considered in the near future as compared with the distant future. Thus, what may seem to be a near-term benefit could be an adverse impact when viewed by future generations. An example could be the disposal of solid wastes in a landfill, whereby the problem of disposal is apparently solved by "sweeping the dirt under the rug." However, if the wastes contain toxic components that are later leached into the ground water, future generations may be faced with unusable ground water sources.

6.2.2.4 Known/Unknown--Experience has shown that the use of some materials such as DDT and PCB eventually led to adverse impacts that were traced to the distribution of these chemicals in the environment. At the time of their initial use, no one knew of the potential impact. If an action involves the distribution of a substance that is not readily degradable, the analysis should include a discussion of its potential hazardous or toxic impacts on flora and fauna. The potential transmission and bio-accumulation of the substance in the food chain should also be considered (e.g., the case of mercury being transmitted from microbiota to eventual accumulation in the tissue of larger fishes). If the consequences are unknown, this should be clearly stated, along with possible reactions.

6.2.2.5 Significant/Not Significant--This is very difficult to define in hard terms. If the change in an element of the environment is not measurable, it can be said to be insignificant. If the change is measurable, but it is small in comparison to the total quantity in an area, it is probably, but not certainly, insignificant (e.g., clearing a few acres of woodland in an area containing thousands of acres of woodland). In general, the analyst should be aware of the subjective judgment involved in reaching a decision. If an impact is small but causes some predetermined limit to be exceeded (e.g., the ppm of a pollutant in air or water), the impact should be considered significant in a regulatory sense.

6.2.2.6 Beneficial/Adverse--The discussion above has emphasized adverse impacts, but many actions can result in beneficial impacts, at least to some elements of the environment. The beneficial impacts are just as real as adverse impacts, and they should be identified and described in the analysis.

6.3 SYSTEMS OF ANALYSIS

6.3.1 Checklist Approach

This approach involves the development of a checklist containing the types of impacts that could occur, then going through the list as part of the analysis, checking off whether a particular impact may or may not occur, and whether it is expected to be significant if it does occur. The checklist itemizes impacts, as opposed to action/environment descriptors used in the matrix approach in which the elements of the matrix are the impacts.

The checklist approach has the advantage that it is simple and to the point, but it is best used for single actions of a similar type, taking place in essentially the same location. For example, it would be good for a test range involving ordnance testing. In this case, a checklist could be prepared that would cover the probable impacts from a variety of test detonations.

The checklist approach also has disadvantages in that it is not readily applicable to multi-action projects, or one-time large-scale projects in which the potential impacts may not be readily identifiable.

6.3.2 Matrix Approach

The matrix approach identifies impacts by arraying descriptors of the action against the descriptors of the environment. A simplified sample matrix is shown in Figure 1. In developing the matrix, all attributes of the action and of the environment should be listed in a generic sense, i.e., without consideration of any specific action. The resulting matrix reflects all possible ways in which the action could impact the environment. Each element of the matrix (each point where a row and a column intersect) is a potential impact.

The advantage of the matrix approach is that it is universal in the application, i.e., not specific to any type of action. As such, it provides a high degree of assurance that all potential impacts will be considered, assuming, of course, that a detailed matrix was developed at the outset. It is also highly applicable to complex or multiple actions, since each action (e.g., a year-long series of different tests) can be entered as an array under the description of the action.

The disadvantage of the matrix approach is that it involves a lengthy evaluation, and the impacts are only identified but not quantified or described in each element. Thus it serves mainly as a tool for identifying potential impacts, which must then be described in the text of the report. Some investigators have tried to produce an overall index of the impact of

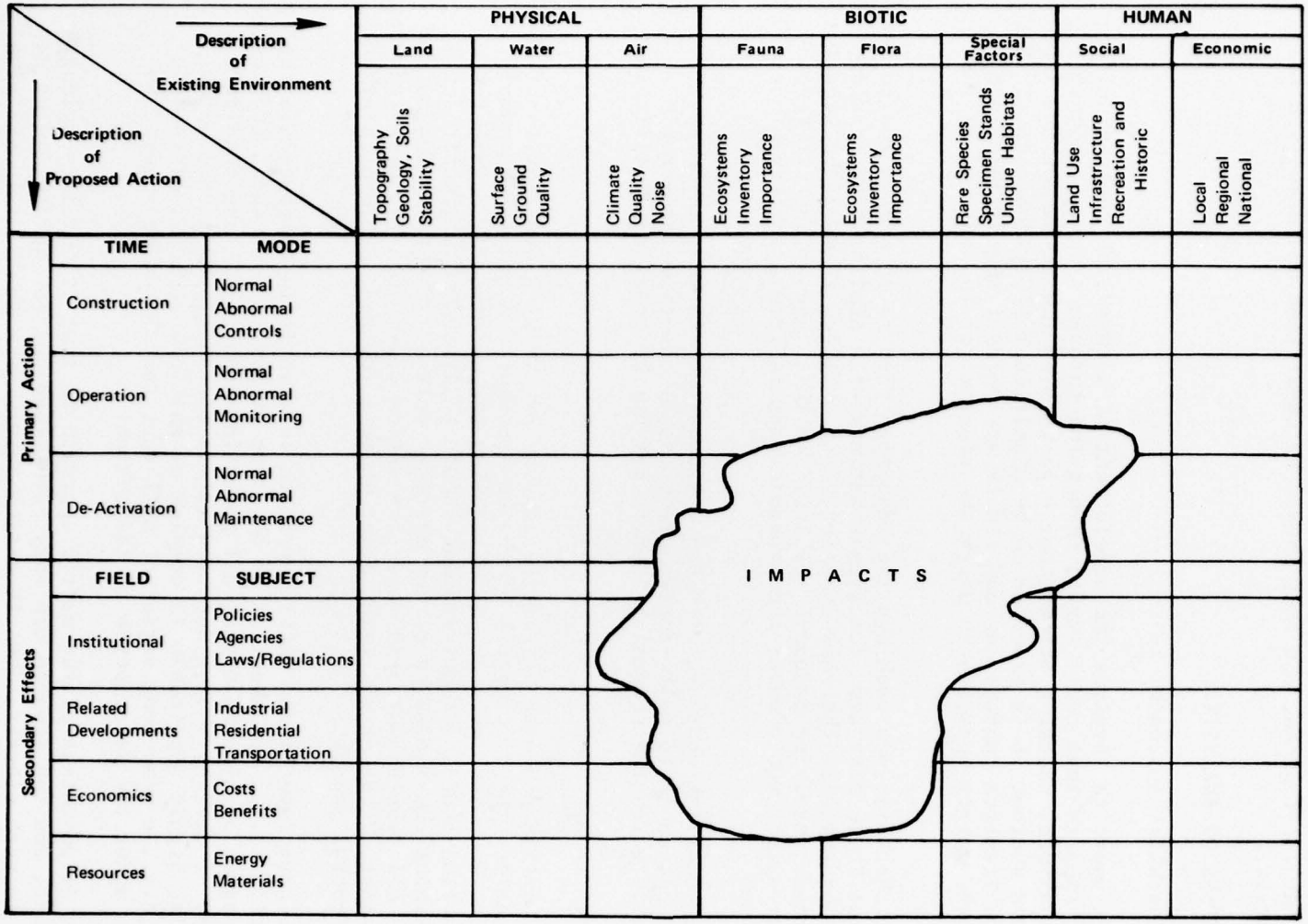

Figure 1 Typical Impact Matrix

a project by assigning weighting values to each element in the matrix, then summing the values in various ways, but this tends to be more of an academic exercise than a useful reporting tool.

6.3.3 Narrative Approach

This approach involves the description of the potential impacts in narrative style, without the use of a checklist or matrix as an aid in identifying the impacts. Since a narrative discussion is required with the checklist or matrix anyway, it may seem that the narrative approach is not unique. However, it differs in that it combines in a single location the description of the action, the description of the environment, and the discussion of the impacts. For example, if the action involves the construction of a new target on a range, the description of the target, its immediate surrounding area, and the impacts of its construction and use are lumped together in a few paragraphs.

The advantage of the narrative approach is that for small actions it provides the reader with a complete report in one place. This can be very useful if several separate actions are being reported in a single assessment report, since the reader can obtain all pertinent information in one location in the report.

The disadvantage with the narrative report as defined is that it relies heavily on the judgment of the writer to include all potential impacts. It is not suitable for large or complex actions in which a systematic approach to the analysis is essential.

SECTION VII

INFORMATION SOURCES AND DATA COLLECTION

7.1 DATA CATEGORIES

The data that are required for the preparation of an environmental assessment fall into two general categories: data about the action or project, and data about the existing environment.

The data about the action can be obtained from the program manager or planners assigned to the project. These sources should be able to provide the description of the action, information about the location where the action will occur, the probable construction activities that will be associated with the action, the nature of the operations involved with the action and any expected emissions (both in qualitative and quantitative terms), and a description of post-action cleanup or treatment.

The data about the existing environment can be obtained from several sources, both on and off base. The data requirements can be broken down into the categorical elements discussed previously in Section V, i.e., the physical, biotic, and human environments and subsets thereof.

7.2 MAPS

A key element in the data collection process is to have good maps of the area involved. The maps fall into three classes.

7.2.1 Regional Map

A regional map (covering an area of about the size of a state) is required to show the location of the installation, nearby communities, major highway systems, and county boundaries.

7.2.2 Vicinity Map

A vicinity map (covering an area of about the size of a large township or county, or one or more USGS quadrangle sheets) is required to show topography, general vegetative cover, small watercourses and drainage systems, and any state or national parks or similar features.

7.2.3 Location Map

A location map (covering an area about the size of an Air Force Base or installation), is required to show the area designated for the action, and other features such as roads, utilities, and buildings.

7.2.4 Map Sources

Maps can be obtained from state or county highway departments, regional planning offices, the U.S. Geological Survey, and from the Base Civil Engineer's Office. If previous environmental assessments or statements have been prepared for actions in the area of the proposed action, they may contain maps that can be used with only minor modifications. Maps may also be available from the Comprehensive Plan Tab A-1 Environmental Narrative for the base involved.

After these maps have been obtained and the location of the action has been marked on the maps, they should be brought to individuals who will furnish the data. Most persons having data files can respond much faster once they can see the location of interest on a map.

7.3 DATA SOURCES

Sources having good data files vary considerably in various parts of the nation. If it is not convenient to visit a data source in person, the best approach is to make telephone calls to likely sources and describe the data that you want. If the data cannot be provided from the requestee's files, ask if the requestee knows from whom the data can be obtained. Usually only a few calls are necessary to find a good data source.

The Base Civil Engineer's Office should be visited at the start. This contact can be established when seeking the location map. It is also likely that the BCE will have other recent environmental assessment or environmental statement reports on file, from which many sections can be adopted for use in the proposed environmental assessment.

One of the best data sources is the Comprehensive Plan Tab A-1 Environmental Narrative for the base involved. This document will include narrative descriptions of the history of the base, its geographical setting, its mission and activities, and descriptions of the natural, biotic, and socioeconomic environments. The Tab A-1 report will also contain tabular data and figures that can be incorporated into the environmental assessment, and references to local agencies from which the Tab A-1 data were obtained and from whom additional data can be requested.

It is not necessary or even desirable to include large quantities of data unless the data applies to an area of significant impact. For example, if the flora in the area will not be impacted by the action, do not include tables listing all the types of vegetation that are common to the area. Data of this type only adds bulk to the report without serving any meaningful purpose.

Information that is not in the form of specific data can also be useful for the assessment process if it can be obtained from authoritative sources. In this context, information means the expressed opinions of persons familiar with one of the environmental areas. For example, a statement or letter from the head of a local historical society, stating that there are no known historical sites in the project area of influence, constitutes a valid source of information. (By comparison, the data covering this subject would be a listing of all historic sites and their location in the county or state involved, followed by an analysis to show that none were in the project locale.)

Town and county officials and agencies can also be useful data sources, particularly planning agencies or departments. The planning groups often have useful land use plans and reports, including listings of local recreational areas, and present and projected demographic data. The local tax commissioner and board of assessors can also provide economic and real estate data. The annual reports of towns or cities can also be useful data sources.

After data and information have been assembled, they should be saved for use in future assessment studies. The establishment of such files is discussed in Section IX. If such a file has been established, it can serve as an excellent source for much of the data required for an assessment study.

SECTION VIII

DOCUMENTATION AND REFERENCING

8.1 PURPOSE

The preparation of an environmental assessment should be viewed as an impartial scientific research and reporting effort. To this extent, it should be independently reproducible by other investigators. The assessment must also be viewed in legal terms to the extent that it represents the response of the Air Force to its NEPA obligations under the law. In this context, the assessment must include documentation and references to

substantiate the data reported and conclusions reached. The inclusion of the references will help to make the assessment report an authoritative document. It will also facilitate the preparation of an environmental statement at a later date, if this should become necessary.

8.2 FORMAT

Referencing is used for data and information sources whether they are published or unpublished printed material or merely verbal communication. References should usually be placed at the bottom of the page on which they first appear. However, if the references are numerous, they may be listed at the end of the report.

The references that are included in the report should be limited to those that reflect substantive data or information items. If a large section of the report is based on a single source, a statement can be made in the text that indicates the source; e.g., "The description of the testing procedures were provided by _____." Minor references can be noted in the margins of the rough draft as a reminder of where the data or information were obtained. These references would not appear in the final assessment.

Documentation refers to the extent of description given in the report of the methods of analyses or procedures used for the assessment. For example, if an air dispersion model were used to estimate the increases in air pollutants, the documentation should include a description of the type of model, its name, the assumptions relating to its use, the input data used, the output, and an evaluation of the output. This type of documentation will permit reviewers to attach a level of confidence to the results that are reported.

SECTION IX

HOW TO ESTABLISH AN ENVIRONMENTAL DATA AND INFORMATION SYSTEM

9.1 INTRODUCTION

Many actions and programs occur in the same general location, e.g., on a test range or within the facilities area of an installation. Much of the data and information that serves to define the pre-action environment is common to all actions and can be used as baseline data for the preparation of many separate environmental assessments. The collection of such data at an installation can be termed an environmental data and information system. It may exist informally as simply a set of documents that are contained in a project file, or it may be located with the general information about the installation, e.g., at the Base Civil Engineer's Office. The environmental data and information system is equally useful for the preparation of environmental statements.

9.2 TAB A-1

The Environmental Plan Tab A-1 Environmental Narrative is an excellent source for data about a base. This document provides the history and background of the base, descriptions of the missions and operations of its tenants, information about the natural, biotic, and social environment, and other baseline information about a base and its surrounding area. Tab A-1 documents are very comprehensive and pertinent sections should be abstracted for use in the environmental assessments. Reference can be made to Tab A-1 as a source, or to the original source if specific data sets are used.

9.3 BASELINE DATA SYSTEM

If it is expected that several environmental assessments, and perhaps some environmental statements, will be prepared for actions at an installation during the coming few years, every effort should be made to establish a data and information system that can be used to provide baseline data for all of these studies. The typical data and information that are likely to be needed are as follows.

9.3.1 Location Map

This should be on 8 x 10-1/2 inch paper, showing the installation area and including a north arrow and identification of key facities. Several copies should be printed in advance, using a grey print shade. One such sheet can then be used as stock background material on which the site of the action can be drawn in black. This master can then be reproduced for the assessment report. By using this procedure, readers of the report can quickly locate the site of the action in relation to surrounding geographic features.

9.3.2 Land Data

Current copies of USGS Quadrangle Sheets should be on file for the installation and surrounding area. Municipal and/or county land use maps, if available, are very useful; however, check to determine whether such maps may have become obsolete due to recent development.

9.3.3 Climatological and Meteorological Data

Tables showing mean monthly temperature, precipitation, and snowfall during winter months can be obtained from reference books or from the U.S. Department of Commerce, National Climatic Center, Federal Building, Asheville, N.C. 28801.

9.3.4 Hydrologic Data

Water resources data on streamflow, water quality, and ground water can be obtained from the U.S. Department of Interior, Geological Survey. Contact the District Chief, Water Resources Division of the district for information.

9.3.5 Air Quality Data

These can be obtained from the Regional Office of the EPA and from state air quality control offices. The locations of monitoring stations in the general area of the installation and the parameters that are monitored should be obtained. Monitoring and sampling data should be obtained annually.

9.3.6 Biotic Data

Data about soils and vegetation can be obtained from the Department of Agriculture, Soil Conservation Service, Forest Service, and from county agents. Data about fish and wildlife can be obtained from the Department of Interior, Fish and Wildlife Service, and from state fish and game offices.

9.3.7 Cultural Data

These data are sometimes available from the Base Information Office. Data about historical sites and areas of archaeological interest can be obtained from persons designated by states as the official historian or archaeologist.

9.3.8 Utilities Data

These are generally available from the Base Civil Engineer's Office or from the local utilities that provide service to the base.

9.4 DATA SOURCE IDENTIFICATION

The data sources described above are only some of the items that could be included in an environmental data and information system. The types of information and the sources will vary in different parts of the country. It is important that the sources of data (i.e., names of agencies and individuals, their addresses and telephone numbers) be included in the file. The date information was obtained should also be marked on each document.

INITIAL DISTRIBUTION

HQ USAF/SGPA	2	AMD/SE	1
HQ USAF/PREV-P	1	ASD/DEI	1
HQ USAF/PREV-X	1	6650 ABG/DEED	1
OSAF/SAFIL	1	6570 ABG/DEE	1
ADC/DEEV	1	3245 ABG/DEEE	1
AFCS/DE	1	AFATL/DLV	1
AFLC/DE	1	AFOSR/XO	1
AFSC/DEV	1	AFRPL/DOF	1
AFSC/SGB	5	AFLC/SGB	1
ATC/DEPV	1	AFLC/DEM	1
AAC/DEV	1	CINCSAC/EA/ES	1
MAC/DEEE	1	CINCSAC	1
CINCPACAF/DE	1	6940 ABG/DEE	1
CINCSAC/DEPV	1	928 TAG/DEE	1
USAFSS/DEMM	1	94 CSG/DEP	1
CINCUSAFE/DEPV	2	440 CSG/DE	1
AFRES/DEEE	1	911 TAG/DE	1
USAFA/DEV	1	934 TAG/DE	1
AFIT/DEM	1	914 TAG/DEE	1
AU/LDG	1	439 CSG/DE	1
AUL/AUL-LSE 70-239)	1	913 TAG/DE	1
3800 ABW/DEE	1	910 TFG/DE	1
AMRL/DAL	1	AFRES/DEPD	1
USAF Environ Health Lab/		OO-ALC/XR	1
Kelly AFB	2	2851 ABG/DE	1
AEDC/DEE	1	2852 ABG/DE	1
SANS /DE	1	2803 ABG/DE	1
AMD/Tech Library	1	2853 ABG/DE	1
TAC/DEEV	1	2854 ABG/DE	1
AFCEC/SUL	1	STTC/DEEE	1
AFETR/DER	1	2750 CES/DE	1
USAF Rgn Civ Engrg/Atlanta	1	CTTC/DEEED	1
USAF Rgn Civ Engrg/		14 FTW/DEE	1
San Francisco	1	29 FTW/DEE	1
USAF Rgn Civ Engrg/Dallas	1	KTTC/DEEP	1
4 Med Srv SQ/SGHB	1	AFMTC/DEEE	1
DDC/TCA	12	47 FTW/DEEE	1
USA CERL	1	LTTC/DED	1
AFCEC/EV	20	323 FTW/DEPD	1
AFCEC/CSV	1	12 FTW/DEE	1
AFCDC/SU	1	64 FTW/DEPD	1
USAF/SAM/EDE	20	438 ABG/DEE	1
AFATL/DLOSL	2	71 FTW/DE	1
1100 ABW/DEE	1	78 FTW/DEE	1
1840 ABW/DEE	1	82 FTW/DEEE	2
6510 CES/DE	1	443 ABG/DE	1
4900 ABW/DEPDE	1	437 ABG/DED	1

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63 ABG/DEEE	1
317 CSG/DE	1
435 CSG/DE	1
375 ABG/DEE	1
60 ABG/DEE	1
67 CSG/DEE	1
27 CSG/DEEE	1
834 CSG/DEE	1
23 CSG/DEE	1
35 CSG/DEE	1
49 CSG/DEE	1
Base Env Coord/Barksdale AFB	1
4500 ABW/DEE	1
58 CSG/DEE	1
56 CSG/DEE	1
347 CES/DEE	1
366 CSG/DEE	1
354 CSG/DEE	1
57 CSG/DEE	1
4 CSG/DEE	1
363 CSG/DEE	1
Base Env Coord/Kincheloe AFB	1
Base Env Coord/K.I. Sawyer AFB	1
Base Env Coord/Loring AFB	1
Base Env Coord/Malmstrom AFB	1
Base Env Coord/Beale AFB	1
Base Env Coord/Blytheville AFB	1
Base Env Coord/Carswell AFB	1
Base Env Coord/Castle AFB	1
Base Env Coord/Davis-Monthan	1
Base Env Coord/Dyess AFB	1
Base Env Coord/Ellsworth AFB	1
Base Env Coord/Fairchild AFB	1
Base Env Coord/F.E. Warren AFB	1
Base Env Coord/Grand Forks AFB	1
Base Env Coord/Griffiss AFB	1
Base Env Coord/Grissom AFB	1
Base Env Coord/Whiteman AFB	1
Base Env Coord/March AFB	1
Base Env Coord/McConnell AFB	1
Base Env Coord/Minot AFB	1
Base Env Coord/Offutt AFB	1
Base Env Coord/Pease AFB	1
Base Env Coord/Plattsburgh AFB	1
Base Env Coord/Rickenbacker AFB	1
Base Env Coord/Vandenberg AFB	1
Base Env Coord/Wurtsmith AFB	1